Contingency Plan
Y-12 SAP Production System
01/19/01

PART I. PRELIMINARY PLANNING

A. PROFILE

- The SAP production system is an integrated set of functional business modules that work together against a common database. This architecture allows real-time access to all company data by the users of these modules.   The functional modules used by Y-12 are: Finance and Controlling (FI/CO), Materials Management (MM), Project Systems (PS), Aeronautics and Defense (AD), Human Resources (HR), and Sales and Distribution (SD). (The SD module is used only for the Accounts Receivable functionality).

- User Community – Y-12 employees who require access to the data and/or functionality of the business areas encompassed by the SAP functional modules listed above.

- Software Configuration Managers – George Dailey, CIO, Y-12

- Processors on which the application executes

    - Database Server: SUN E3500 located in Y-12 9103 Computer Center
    - Application Servers: Three SUN E450 Servers located in Y-12 9103 Computer Center
    - WWW interfaces to SAP run on COMPAQ Windows NT servers located in the Y-12 9103 Computer Center.

- Run Frequency and Time – continuous except for scheduled backups and maintenance

- The SAP software is Unclassified/Sensitive

- The SAP hardware is Unclassified/Sensitive

B. ESSENTIAL FUNCTIONS

- The business modules within SAP perform specific functions related to each business area. Some of these functions are considered mission essential while others are not considered mission essential. However, since SAP is a fully integrated system sharing one database, the entire system is classified as mission essential.

- The following modules/functions within SAP have been identified as having special time and/or resource needs that must be addressed in a recovery scenario. In the event that a recovery to the disaster recovery site results in limited resources and limited SAP functionality, every effort will be made to ensure that these mission-essential functions of SAP can execute within the maximum allowable downtimes specified.   Under normal

recovery procedures, SAP and all it's associated functionality will be recovered, but this identification and prioritization of mission essential functions will ensure that the company can meet it's critical requirements if resources are limited. Those modules with special needs and/or time-critical functions are:

CO (Controlling Module)

The Controlling module of SAP is where indirect cost is captured, grouped or re-categorized and ultimately distributed to Final Cost Objectives. Numerous external interfaces are involved in this process, both for initially capturing source data and for facilitating the redistribution of cost. The module works concurrently with the Project Systems module to comprise the "cost accounting system".

Special requirements needed to perform this function

The CO (Controlling) module must be able to receive data from both Payroll, Absence, and Labor (PALS) and the SAP HR module.

Maximum Allowable Downtime

Cost and commitment information for programs is due to DOE and other companies on a monthly basis. The most critical reporting is the fiscal year end close-out period (September 30).

Legal reporting is due on a monthly basis. During the last 2 days of the calendar month and the first 2 two days of the calendar month, the Controlling module could only accept a one day downtime. Any other time of the month, downtime is not as crucial, but every effort will still be made to restore the system within 24 hours.

Feeder system dependencies

PALS is an essential feeder to the Controlling module. This system has a disaster recovery procedure that would take effect in the event of a disaster. The following feeders are needed, but not critical to a single month of costing:

Analytical Chem. Div. ACD
Admin Reproduction ADREP
ASO-Y-12 ASOY
Copier System COPY
Eng. Drawing Reprod EGREP
Eng Mgt Info Sys. EMISAE
Govt. Printing Office GPO
Interlibrary Loan/Do Deliver Service ILLDS
Interlibrary Loan/Do Deliver Service 2 ILLDS2
Isotopes ISOTOPE
Ordering Systems ORDER
Ordering Systems 2 ORDER2
Photography PHOTOX
Photography PHOTOY
Online Library Searching Services SEARCH
Travel TRAVEL
Video Services VIDEO
Waste Mgt Trg Systems WMTRAN

X-10 Eng Drawing Reprod XEGREP
Government Transfers GT
MK Ferguson Invoice Data MKF
Foster Wheeler Distribution FW
Isotope Production Effort ISO

SD (Sales and Distribution) Module (used for Accounts Receivable functionality)

The SD module requires a maximum downtime of 1 day between the 16th and 20th days of each month. Transfer vouchers must be submitted by the 20th. It is also required that SD be available during the last 2 days of each month and the first 2 days of each month due to shared processing with the CO module.

The Materials Management (MM) and Project Systems (PS) do not, at this time, have time critical functions that require a maximum downtime.

HUMAN RESOURCES MODULE (Payroll)

The Human Resources module provides functionality for payroll and benefits administration as well as personnel management functions such as organizational management, recruiting, grievance tracking, training, and EEO.   The HR module is fully integrated with the other SAP functional modules (MM, FI/CO, PS, and SD) and is therefore included in the overall SAP disaster recovery plan. However, due to the critical nature of payroll, an alternative recovery plan for payroll is outlined in appendix A.   This plan will be used if the overall disaster recovery cannot be performed in time to meet payroll deadlines.

<u>Special requirements needed to perform this function</u>

Must be able to receive data from required feeder systems. (see feeder system dependencies list below). In a disaster recovery scenario, network access to both internal and external networks should provide access to the required data. The primary outputs from a payroll run are the ACH file, which is used to transmit electronic deposit information to the banks, and the Westcorp file which is used to print paper checks for employees who request this type of payment.   There are ACH transmission machines and printers/software for the Westcorp files located at the Y-12 disaster recovery site.

<u>Maximum Allowable Downtime</u>

The Human Resources Payroll functionality must be available Monday and Tuesday of each week for processing of the weekly payroll.   In addition, the monthly payroll run requires availability for a window of approximately 48 hours during the Wednesday and Thursday preceding the monthly submission of the ACH file, which occurs two days prior to the official pay date. During these periods, uptime is critical. Any outages approaching 6-8 hours during these periods will invoke preparations for using the procedure outline in Appendix A for emergency payroll runs without SAP.   All decisions concerning emergency payroll runs will be made by the Y-12 Payroll offices along with the CIO.

<u>Feeder System Dependencies</u>

The following systems provide and receive input to/from SAP. However, during an emergency, the only required input to SAP is from the PALS system. **If SAP is operational and PALS is unavailable** for input to the SAP payroll process, a routine can be run that creates IT2010 and IT01 records for a straight 40 hours for weekly/hourly employees and 173.3 hours for monthly employees and this data will be used as a substitution for PALS input to the payroll run. A second file that deducts the hours will also be created for use during the next normal PALS/SAP Payroll run once PALS is operational again.

Data dependencies for other feeder/needer systems will be reconciled once SAP is operational again.

Imports into SAP
PALS – time data
State Street Bank – Savings Plan Changes, Demographics and Eligibility
State Street Bank – Savings Plan Employee Payroll Updates (Deductions)
Educational Assistance Reimbursement
IRS/SSA
Medical Occupational Health Information System (MOHIS)
One Call Benefits
Building Table (Room Table)
Positive Discipline History

Exports from SAP
Due to the large number of exports from SAP, these references will be included as Appendix B.

C. ESSENTIAL SUPPORTING APPLICATIONS

- As mentioned in the previous section, the PALS system is a required feeder system to the CO and HR modules. See the previous section for other less-critical CO and HR feeder systems.

D. ESSENTIALITY

- The SAP system has been determined to be Mission Essential

- Maximum Acceptable Application Downtime – 8 hours during the critical HR periods specified in Part 1, Section B (Essential Functions). The CO and SD modules have a maximum downtime of 24 hours during their critical processing times as specified in Part I, Section B. (Essential Functions). It is understood that it could take several hours after a disaster occurs to assess the situation and make a decision regarding recovery to the alternate site. The maximum downtime periods specified above will begin after this decision has been made.

- Events Included – This contingency plan is directed at natural disasters or sabotage that render the SAP machines in the 9103 Computing Center inoperable for an extended period of time. These events include:

  - Fire
  - Natural Disasters (tornado, flood, etc.)
  - Hardware failure that cannot be remedied within the maximum acceptable downtime
  - Sabotage (bombs, vandalism)

- Excluded Events – This contingency plan will not cover events that cause minor short-term disruptions to SAP operations. Nor will it cover catastrophic events that would render recovery impossible, or impractical, due to extensive concurrent damage to both the primary and disaster recovery sites.

  - Minor Excluded Events - events in this category will be evaluated on a case-by-case basis and could result in recovery to the disaster recovery site if the outage is prolonged and is severely impacting business needs. Normally these events can be remedied in a timely manner by repair or replacement of parts.

    ➢ Hardware/Software component failure
    ➢ Minor database corruption (that can be corrected in a reasonable amount of time)
    ➢ Temporary Computer Center problems such as power outages or air conditioning problems.

  - Major Excluded Events - events in this category could result in the loss of both the 9103 and 9117 computing centers. To ensure recovery from this type of event, additional disaster recovery preparations would be needed such as further geographical separation between the primary and secondary sites, or the addition of a third recovery site that includes a separate SAP/Oracle database.

    ➢ Earthquake
    ➢ Natural Disasters that effect both computer centers
    ➢ Sabotage that effects both the computer centers
    ➢ Major Database corruption that effects both the primary and disaster recovery sites

  At this time, this document does not cover contingencies relating to the temporary, or permanent, loss of the disaster recovery site. During outages at the disaster recovery site, there will be no immediate recovery options available for the primary production SAP instance until the alternate site comes back online. Our service contract with our hardware vendor, SUN Microsystems, provides for fast replacement of parts so downtime due to normal hardware failures, etc., should be minimized.

  It should also be noted that the primary Y-12 networking hardware is located in the 9103 computing center. If this building is destroyed or severely damaged, then the networking within Y-12 and with outside sites, including the disaster recovery site, could be disabled. A prolonged network outage that disabled network communications within Y-12 disaster recovery site would require that personnel working on time-critical functions within SAP temporarily relocate to 9117 in order to have network connections to SAP.

E. SUPPORT COMMITTMENTS

- Availability of replacement hardware and licensed software

- Replacement hardware will reside at the Y-12 9117 Computer Center. The hardware being used for the SAP Quality Assurance (QAS) environment will be used as the production disaster recovery hardware. It has been sized appropriately for this potential use.

- The recovery software will reside on the mirrored production disk array at the Y-12 9117 Computer Center. It will also reside on backup tapes that will be stored at the 4500 North site. Software included will be SAP, SUN Solaris, Oracle, and Veritas Volume Manager.

- Utilization of another ADP facility

  - The Y-12 9117 Computer Center has been designated as the SAP disaster recovery site. It will contain the appropriate hardware and software to provide recovery of the SAP system should the SAP hardware at 9103 become inoperable.

- Availability of personnel

  - Y-12 SAP personnel and vendor representatives will be available per employment and/or contractual agreements.

  - During a recovery process, the support personnel would require access to the Y-12 Computer center. Access to this center requires a Q-clearance or an escort for uncleared personnel. Currently all necessary support personnel have Q-clearances. If, in the future, an uncleared person becomes critical to the recovery process, an escort agreement will be established to allow easier access on short notice should an emergency occur.

F. RESPONSIBILITIES

- Responsibility for recovering the SAP system to the alternate site is the responsibility of the SAP Technical Team. They will be automatically notified of a disaster per standing support arrangements with the Y-12 Computer Centers and will contact the necessary personnel needed to evaluate the situation and begin the recovery process to the alternate site if necessary. Since the decision to recover to the disaster recovery site implies potentially significant downtime and operational changes, this decision will be approved by the CIO of Y-12.

G. BACKUP REQUIREMENTS

- For disaster recovery purposes, the SAP backups will be the mirrored production disk array that permanently resides at the Y-12 Computer Center. The recovery action plan will provide procedures for recovering SAP using this mirrored disk array. In addition, weekly tape backups of the production system will be stored at the disaster recovery site or another offsite location (4500 North). If for some reason the mirrored disk array is not available for recovery, these tapes could be used for recovery. However, depending on the timing of the disaster, recovering from tape may result in the loss of data.

- A copy of the production "boot" disk will be made to a disk on the disaster recovery machine (SAPYQADB) each week, or after each significant structural change to the SAP file systems. This disk will allow the disaster recovery machine to recognize and use the mirrored production disk array instead of it's own disk array. This disk will include all the necessary information about file structures contained on the production disk array.

The technical procedure for copying this boot disk is included in the Backup and Recovery Operations section of this document.

- A permanent network IP address on the Y-12 subnet will be established and will be used by the SAPYQADB machine once it becomes the production machine.

- The QAS application servers located at Y-12 should be configured to allow them to be booted up against the production server. This will allow them to be converted to production application servers by rebooting them using the production profile.

- The necessary SAP documentation needed to recover SAP and resume operations will be stored at the alternate site in either hard copy or electronic form.

- An adequate supply of magnetic tapes should be available to enable resumption of the regular backup schedule for SAP once normal operations are restored.

- (Note: additional items such as special print forms, network connections to outside institutions, special personnel needs, etc., will be included in this document once they are identified).

H.   TEST PLAN

- A physical test, or a detailed review, of the disaster recovery procedures will be conducted yearly to ensure continued recovery capability. The physical test will consist of a simulated disaster at the 9103 site, which can be accomplished by simply disconnecting the SAP production machine from the mirrored disk link or by shutting down power to the machine. This results in the primary SAP production machine at 9103 machine being unavailable with the mirrored disk array at 9117 still intact. The recovery process that will convert the Y-12 QAS SAP instance to the production instance will follow the procedures outlined in Part II of this document in the "Backup and Recovery Operations" section.

  This plan has been successfully tested three times to date utilizing the existing shared hardware between ORNL and Y-12, with the most recent, and final, test completed on August 7, 1998. A representative from SUN Microsystems' SAP Competency Center was present to observe the results of this test. This test was accomplished by abruptly shutting off power to the production SAP machine at ORNL during a period of heavy processing and then following the recovery procedures to use the mirrored disk at Y-12 and the Y-12 QAS machine to recreate the production environment. The process took approximately 2.5 hours. Feeder system dependencies and Web interfaces were not addressed during this test due to their still being under development. However, in a real disaster scenario, if the primary SAP instance can be successfully recovered to the disaster recovery site and reconnected to the Y-12 network, then the necessary access to critical feeder systems (primarily PALS) will be available as long as those systems are running properly.

  If a physical test cannot be conducted yearly due to business constraints, a conference-room review of the recovery process will be performed. This review will include all affected personnel and documentation and will cover the disaster recovery process step-by-step to ensure that the plan is still feasible and properly documented. This type of review will be a sufficient substitution for the physical testing as long as no significant changes have been made to the SAP and/or hardware systems, since the last successful test, that would negatively impact or jeopardize the recovery process. The results of this review and/or test will be reflected within this document. Any recommendations

incorporated within will be routed for CIO approval.   Appendix C shall be utilized to detail these walkthrough results.

Although the 3 previously performed DR tests did not utilize the newly acquired Y-12 hardware, the Y-12 specific SAP landscape has been designed and verified functionally equivalent to the previously tested scenarios.

PART II.   ACTION PLAN

I.   EMERGENCY RESPONSE

- In the event of a disaster that disables the SAP computers, the SAP technical team will be contacted. They will assess the situation and determine if recovery to the alternate site is required. If so, they will contact the Y-12 CIO for approval. Once this approval is granted, the recovery operation will be begin as outlined in the following section, "Backup and Recovery Operations".

- If email capabilities are available, a message will be sent to the user community to communicate the status of the SAP system. If email is not available, then the messaging functions within SAP will be used to communicate with end-users.

J.   BACKUP AND RECOVERY OPERATIONS

In the event of a disaster that requires recovery to the alternate site, the following procedure should be used.   This information, plus any additional technical detail will be located in the 9117 machine room in close proximity to the hardware that will be used for recovery.

- The Y-12 computer operations group will notify the on-call members for both the SAP Technical team, and COSPOOL that damage has occurred at the 9103 computer center that could effect the functionality of the SAP machines. The SAP Technical team and COSPOOL representatives will assess the situation to determine if recovery to the alternate site is needed.

- Notify the CIO of Y-12 and get approval to recover to the Y-12 site

- Members of the SAP technical team and COSPOOL will shut down the QAS instance of SAP that runs on the Y-12 SAPYQADB machine and perform the recovery as described in the following technical procedures.

Beginning of Technical Instructions for recovery preceded by the instructions for maintaining weekly copies of the SAPYPRDB boot disk.

I. Weekly Duplication of the SAPYPRDB Operating System Volume on SAPYQADB

Each week, a COSPOOL member duplicates a copy of SAPYPRDB's operating system volume onto a SAPYQADB scsi disk via an A5200 disk that is accessible to both SAPYPRDB and SAPYQADB.

1. On SAPYPRDB: Transfer a copy of the SAPYPRDB scsi boot disk (c0t0d0s2) to an A5200 disk (c3t88d0s2) physically located at Y-12 but available to both SAPYPRDB and SAPYQADB. This step, which utilizes the "dd" command, takes approximately 20 minutes. After the copy has completed, run the file system check program ("fsck") on the newly-copied filesystems to check their integrity.

2. On SAPYQADB. Using "dd", copy the contents of the common A5200 disk c3t88d0s2 to c0t7d0s2 (the scsi disk which is bootable by SAPYQADB). To check filesystem integrity, run the "fsck" program on the newly-copied filesystems.

   NOTE: A5200 disks are not bootable.

3. While still logged in on SAPYQADB, disable the common A5200 disk (c3t88d0s2) to prevent it from potentially causing problems with the boot process on SAPYPRDB. To do this, using "vxdiskadm", add it to the "swapdg" disk group as disk06, initialize it, then remove it from the disk group. This will sufficiently overwrite the disk so that it does not cause problems.

II. Bringing up SAPYPRDB on the SAPYQADB Hardware

In the event the existing SAPYPRDB system is unusable and the decision has been made to bring the system up on SAPYQADB at Y-12, the following steps need to be done.

1. Prepare the copied disk (c0t7d0s2) to become the boot disk.

   a. Mount the c0t7d0s0 disk partition on /mnt

   b. Edit /mnt/etc/nsswitch.conf: Change the line "hosts: dns files" to "hosts: files dns". This causes the system to decipher host address from the local /etc/hosts file instead of the nameserver. (This can be changed back once you are satisfied step "b" has been completed.

   c. Prevent SAP from starting once the system is rebooted by changing to the /etc/rc3.d directory and renaming S30sap to K30sap.

2. Shutdown the SAPYQADB system and prepare to boot it as SAPYPRDB.

   # shutdown -i0 -g5 -y "bring up SAPYPRDB on this hardware"

3. Boot up the SAPYPRDB system on the SAPYQADB hardware: (Note that "drdisk" is a system environment variable on the eprom for disk c0t7d0s2.) At the "ok" prompt, type:

   boot drdisk -r

Stop in single-user mode on the way up and run "fsck -op"
to check filesystem integrity.

4. Use the following commands in order to increase swap space from
   2 GB to 10 GB, the amount of swap space required by SAP:

   # vxprint -vt
   # vxdg -fC import swapdg
   # vxrecover -sb
   # swap -a /dev/vx/dsk/swapdg/swapvol01
   # swap -a /dev/vx/dsk/swapdg/swapvol02
   # swap -a /dev/vx/dsk/swapdg/swapvol03
   # swap -a /dev/vx/dsk/swapdg/swapvol04

5. Bring the system up to multi-user (CTRL-D) and check out the system to
   see if everything is working properly before starting up SAP. These commands
   enable you to check filesystems and volumes:

   # df -k
   # vxprint -vht

6. Start up SAP:

   # /etc/init.d/sap start

7. If the system is going to be functioning as SAPYPRDB any length of
   time, the boot-disk eeprom needs to be changed. To do this, type:

   # eeprom boot-disk=drdisk

III. Returning SAPYQADB to it's Normal State

Once notified that the the SAPYPRDB hardware has been restored to service,
do the following to return SAPYQADB to it's normal state:

1. On the SAPYQADB hardware (while it is still up as SAPYPRDB),
   stop SAP and deport swap:

   # /etc/init.d/sap stop

   # vxdg -h SAPYQADB deport swapdg

2. Shutdown the SAPYPRDB system:

   # shutdown -i0 -g5 -y "resume operation at Y-12"

3. Reset the boot-disk parameter to "disk1". At the "ok" prompt, type:

   eeprom boot-disk=disk1

4. Boot to single-user mode:

   boot -s

5. Increase the swap space from 2 GB to 10 GB:

```
# vxprint -vt
# vxdg import swapdg
# vxrecover -sb
# swap -a /dev/vx/dsk/swapdg/swapvol01
# swap -a /dev/vx/dsk/swapdg/swapvol02
# swap -a /dev/vx/dsk/swapdg/swapvol03
# swap -a /dev/vx/dsk/swapdg/swapvol04
```

IV. Boot SAPYPRDB on the SAPYPRDB hardware at 9103

1. Log in on SAPYADM1and run "sapycon" to get to the SAPYPRDB console.

2. Turn the key to the "on" position (not to "secure"). Once power
   is applied, the system will attempt to do an automatic reboot.
   Interrupt the system (CTRL-T, "send break") so that it can be
   brought up in single-user mode.

3. At the "ok" prompt, type:

```
boot -s
```

4. Check file system integrity by typing:

```
# fsck -op
```

5. Prevent SAP startup:

```
# cd /etc/rc3.d
# mv S30sap K30sap
```

6. Boot to multi-user mode (type CTRL-D).

7. Using saplicense, load hardware key DUYPGJRLNLJQTYSQYQMOGJLF.

```
# saplicense –install
SAP SYSTEM ID = PRD
  Specify your hardware key:
HARDWARE KEY =  R0305604381
  Specify your license key:
LICENSE KEY =   DUYPGJRLNLJQTYSQYQMOGJLF
EXPIRATION DATE: 9999/12/31
```

8. Start up SAP when ready:
```
# cd /etc/rc3.d
# mv K30sap S30sap
# /etc/init.d/sap start
```

   The system is ready for use at this point.

9. Disks will begin resyncing immediately after the system is booted.
   Mirrors which have moved to the 9117 disks will need to be moved back
   to the 9103 disks. This entire operation, transparent to users,
   takes approximately 14 hours.

APPENDIX A

Process for running payroll if entire SAP system is down

In the event that the entire SAP system is unavailable at the time of payroll processing and there is not sufficient time to implement the overall contingency plan, the following procedures should be used to print all employees a paper check using data from the last successful payroll run.

1. Retrieve the previous week's Westcorp check and stub files and combine into one "check" file that will pay the previous week's net pay (no earnings and deductions).   Make appropriate modifications to reflect current date, etc. Also, a block of check numbers must be specified that will not conflict with the normal SAP check number sequence.

2. Submit file to the Westcorp software to print checks. Distribution of checks will be manual for normal manual delivery and by U.S Mail for all others.

3. Address positive pay issue by informing the bank that is processing payroll checks of the new block of check numbers used for the emergency situation.

4. Create IT15 and IT221 records from the modified Westcorp file for use in reconciling SAP once the system is operational again.   The IT15 record states what was paid to each employee and will be used to deduct the amount paid to the employee during the next successful payroll run. The IT221 records are used by SAP for record purposes.

5. Once SAP is operational again, run payroll as soon as possible using the IT15 and IT221 records as input. This will reconcile the employee pay accounts.

This process of deducting a payroll payment from an employee in a future payroll run is the same as the common and tested practice of advancing vacation pay and deducting the pay in the next available pay cycle.

* Note: This process is the responsibility if Payroll Operations and is documented and maintained in their operating procedures.

APPENDIX B

A spreadsheet containing the imports and exports to/from SAP can be found at the following location..

\\delta1\saparea\HR\Interfaces\Master_HR_Interface_job_Detail_List

APPENDIX C

SAP Contingency Plan Review

Date Performed	Reviewers	Comments
01/19/2001	Bill Brisco Michael Muir	Added the key for switching QAS to PRD
04/06/2001	Bill Brisco Michael Muir Otis Peterson Teresa Birchfield	Modified PRD Backuip License to new BWXT-Y12 customer number. Added TEB to contact list

SAP Technical Team Call List

In the event of an emergency, use this call list to notify the SAP Technical team.

	Office	Home	Pager
Becky Bolling	576-5051	483-4848	873-4315
Bill Briscoe	574-3325	482-886	417-5576
Scott Wood	241-1749	584-9013	873-6923
Otis Peterson	241-6545	675-6847	873-6563
Mike Brandon	574-8705	694-4158	417-5497
Mike Muir	574-9509	966-7976	417-5018
Teresa Birchfield	576-5108	423-346-2568	

Signatures:

George Dailey, CIO, Y-12   _____   Date: _____

Mike Muir, SAP Tech Mgr.   _____   Date: _____

Y-12 CTSO Representative   _____   Date: _____